

EcoPhi

Maximizing Efficiency of Grid-Connected Solar PV Systems with Integrated Diesel Generators and Battery Storage, Leveraging Power Pricing

In South Africa

2023 - Ongoing





Background

In countries with either planned or unplanned power outages, PV systems are often combined with a battery storage and Diesel generators to make sure that they are running smoothly during grid blackouts.

Having several energy sources within one system increases its complexity which makes it more difficult to manage all components at the same time. Additionally, fluctuating and dynamic grid prices increases the necessity of optimizing the complete system with all its components based on several factors like grid prices or generator usage.

This case study explains in one example, how the EcoPhi solutions can optimize such kinds of systems. It shows how operational costs are being reduced by optimizing grid and fuel consumption.



System Facts

- 🔋 Residential complex in Johannesburg
- 🔋 4x 100kW SunGrow Inverter (110kWp)
- 🔋 1x 100kW Huawei Inverter (60kWp)
- 🔋 3x 500 kVA Diesलगенсets

EcoPhi components & features

- 🔋 EcoPhi Pro Box
- 🔋 EcoPhi Energy Meter (Grid)
- 🔋 EcoPhi Energy Meter (GenSet)
- 🔋 Irradiation Sensor
- 🔋 Hybrid System optimizer
- 🔋 Platform: Fleet overview, condition monitoring, Alarms



In a nutshell- What we are covering here

- Optimizing Battery usage and Grid consumption.
- Optimizing PV and generator depending on fluctuating grid energy prices.
- Use low grid prices to fully charge the system and use high grid prices to reduce consumption from the grid.
- Released stress on the system's components.
- Visualization of the energy flows and cost savings.
- Performance check and alarms in case of deviations.
- Condition monitoring and maintenance schemes.

In detail

Grid prices: Battery and grid optimization

The EcoPhi Pro Box system is designed to optimize energy usage in relation to grid pricing, leveraging the capabilities of battery storage and solar power to achieve cost-effective energy management.

Strategy During Low Grid Prices:

1. **Battery Charging:** When grid prices are low, the system prioritizes charging the battery inverters to their full capacity. The charging continues until a pre-set limit, which in this case is 70% State of Charge (SoC).
2. **Grid Consumption Reduction:** Upon reaching the 70% SoC limit, the EcoPhi Pro Box automatically reduces grid consumption to 0.0 kW. This is done without discharging the battery.
3. **Utilization of unused PV Power:** Any surplus power generated by the PV system, which is not needed for immediate consumption, is directed towards further charging the battery storage.

Strategy During High Grid Prices:

1. **Utilizing PV System:** During periods of high grid prices, the system's first response is to use power from the PV system to minimize grid consumption.
2. **Battery Power Utilization:** Following the PV system, the battery power is then utilized to further reduce dependence on the grid.
3. **Battery Power Regulation:** The Batteries are utilized and discharged up until 25% SoC (Level Adjustable). This ensures that enough power remains in case of a power outage or load shedding for fuel saving mode and diesel compensation.

The pricing scheme of the national energy grid is based on a 24 hour scheme that can be adjusted regularly. External data points can be implemented, so that the energy prices can automatically or manually be updated.

The EcoPhi Pro Box stands out in the case for its ability to integrate and optimize various components, including **generators, inverters and batteries from different manufacturers**. This flexibility enhances overall system efficiency and adaptability.

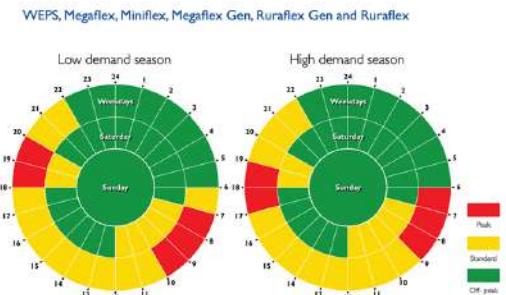


Figure 2: WEPS, Megaflex, Megaflex Gen, Miniflex, Ruraflex Gen and Ruraflex Gen: low and high demand seasons TOU periods





In detail

Grid Outages: PV, generator and battery optimization

In the event of a grid outage, the EcoPhi Pro Box efficiently manages multiple operational modes. Its initial strategy is to run the system solely on solar power (PV) and battery storage.

When the battery has sufficient charge, it is utilized to minimize fuel consumption. Priority is given to using energy from the PV inverters, with battery power as a backup when PV energy falls short.

If the battery's charge drops below a predefined threshold (set at 20% in this instance), the generator will automatically start to maintain power during the outage.

The EcoPhi Pro Box controls the operation to ensure the generator runs at its most efficient level, thus avoiding inefficient power usage.

In this scenario, the generator charges the battery to a specific level (commonly 80% State of Charge). Once this level is reached, the generator is turned off, and the system reverts to using battery power, further optimizing energy use during grid outages.

WEPS, Megaflex, Miniflex, Megaflex Gen, Ruraflex Gen and Ruraflex

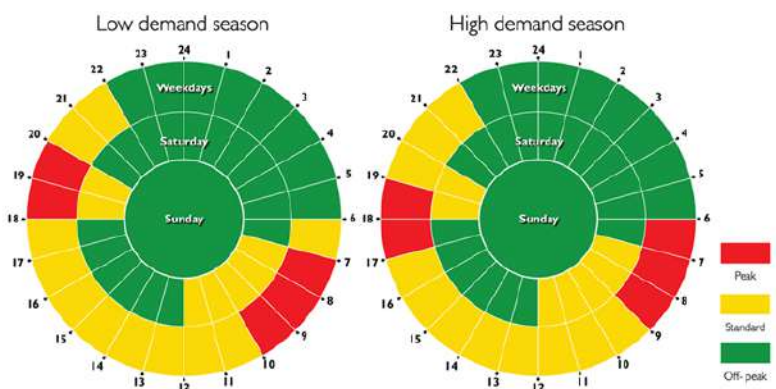


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In detail

Monitoring and Display of System Performance

In addition to optimizing its operation, the system continuously compares the output of the solar panels with the actual solar radiation received. Should there be significant discrepancies between the generated solar power and the potential output as indicated by the measured solar radiation (possibly due to issues like damaged solar modules, dirt accumulation, or component failures), an immediate alert is triggered.

The system's comprehensive visualization on a unified dashboard allows for rapid analysis of all its components. This not only facilitates quick identification of any issues but also enables the quantification and comparison of savings achieved through the system's operation.



How did the EcoPhi Solutions Enhance Efficiency and Savings

EcoPhi's Impact

EcoPhi's innovative solutions are designed to optimize grid and diesel consumption, leading to significant cost savings. In this example case, our approach can save Diesel costs and reduce energy from the grid at the same time, amounting to substantial savings.

Key Features and Benefits

- ④ **Multiple Diesel Generator Management:** EcoPhi excels in managing numerous Diesel generators operating in load demand mode.
- ④ **Solar PV Efficiency:** We ensure the efficient use of Solar PV systems, even when multiple generators and batteries are in operation.
- ④ **Advanced Monitoring:** Our system provides string-level data per inverter, facilitating quick and accurate fault identification.
- ④ **Alert System:** The integration of email and SMS alerts empowers O&M managers with fast response times to address potential issues.
- ④ **Centralized Dashboard:** Customers now have the advantage of accessing all system data on a single dashboard, enabling them to track savings and system performance effectively.
- ④ **Remote Control Adjustments:** Adjustments to control parameters can be made remotely, enhancing flexibility and response time.





Why Choose EcoPhi as Your Partner

- 🌱 **Integration Expertise:** EcoPhi specializes in integrating multiple components within a system, ensuring a seamless operation.
- 🌱 **Manufacturer Independence:** We offer solutions that are independent of manufacturers, tailored to meet our customers' unique requirements.
- 🌱 **Flexible Adaptation:** Our control and software solutions are adaptable to both system and customer needs.
- 🌱 **Comprehensive Solutions:** We provide an all-in-one package, including monitoring and control boxes, sensors, controls, cloud platform features, and customized adjustments.
- 🌱 **Global Experience:** With experience in various green energy projects across over 30 countries worldwide, EcoPhi stands as the ideal partner for your energy projects.

Get in touch with us

Don't hesitate to get in touch with us and get more details on how we optimize systems like this one or other use cases.



EcoPhi
EMPOWERING CLEAN TECHNOLOGIES

www.ecophi.io
+49 721 18126741
contact@ecophi.de

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